Canadian Association of Professional Apiculturists
L'Association Canadienne des Professionels de l'Apiculture

CAPA Statement on Honey Bees Losses in Canada (2010)

Over the winter of 2009-10, losses in Canadian beekeeping were twenty-one percent of the number of colonies that were wintered. Though this represents 1.4x the long-term winter loss rate for Canada, this is a substantial improvement over the previous three-year period during which losses averaged 32.6%.

Table 1. Gross Losses by Province, Winter 2009-10.

Province	Number of Colonies Wintered	Number of Dead or Unproductive Colonies[1]	Wintering Losses (% of Provincial Total)
British Columbia*	41,108	9,882	24.0
Alberta	250,762	43,883	17.5†
Saskatchewan	90,000	18,450	20.5
Manitoba*	78,000	19,968	25.6
Ontario	81,200	17,523	21.6
Quebec*	39,182	8,346	21.3
New Brunswick*	8,800	1,795	20.4
Nova Scotia*	19,000	7,961	41.9
PEI*	3,920	655†	16.7‡
CANADA	**611,972**	**128,463**	**21.0% (of National Total)**

[1] Dead and commercially unproductive colonies as of 1 May 2010. Figure calculated from provincial loss rates (derived from survey data) and total colonies put into winter.
* Denotes participation of province in National Harmonized Survey and their ability to share comprehensive data for analysis.
† Based on surveys of producers in Alberta with 400 or more colonies.
‡ Wintering losses and number of dead colonies from PEI calculated as of 15 April 2010, as insufficient data available for calculation of losses on 1 May 2010.

General Trends

In the years subsequent to the introduction of the ectoparasitic mite *Varroa destructor* into Canada, normal long-term overwintering mortality has been considered to be 15%. During the winter of 2009-10, mortality due to wintering losses and spring dwindling was 21.0%, or 1.4x the normal rate. This loss is substantially less than the 2008-09 mortality figure of 33.9% and is also less than rates of 35.0% and 29.0% recorded respectively for the winters of 2007-08 and 2006-07. Though

encouraging, it is too early to determine whether this decline in mortality constitutes a sustained improvement in colony health.

Compared with the previous three years, mortality across regions has been less variable and generally lower. Extension professionals in Canada attribute the improvement in colony losses, in part, to the availability of a new *Varroa* mite control product, Apivar®, which contains the active ingredient Amitraz. This product was made available to beekeepers under emergency use registration (EUR) for the fall of 2009. Effective use of existing mite control products, such as those containing formic or oxalic acid, also contributed to improved mite control in 2009-10.

Additional factors that contributed to increases in colony survival in 2010 were enhanced sampling and control for the honey bee internal parasite *Nosema ceranae* as well as greater intensity of monitoring for other pests and diseases in major beekeeping areas.

National Harmonized Survey

As an effort undertaken by CAPA in 2009-10, a common set of survey questions was devised in order to harmonize the precise nature of data collected across Canadian provinces and to enable better comparisons to be made across regions. Also during this year, Canada was approached to participate in an international survey of colony losses with an international scientific group, known as COLOSS (Prevention of Honey Bee Colony Losses), a European Union-funded Cooperation on Science and Technology (COST) Action (FA0803). Consequently, the resulting Canadian National Harmonized Survey contained a blend of questions specific to Canadian beekeeping practices, along with others meant to harmonize with surveys being conducted internationally.

Surveys were carried out via mail and telephone interviews. The provinces of Prince Edward Island, Nova Scotia, New Brunswick, Quebec, Manitoba and British Columbia were able to implement the National Harmonized Survey and allowed these data to be shared for common analyses and reporting. Concerns regarding privacy of producer information prevented sharing of detailed survey responses from Alberta and Saskatchewan, while the date of implementation of the survey in Ontario precluded access to these data. Responses of individual beekeepers were supplied without any identifying information, including that pertaining to locality below the level of the province of origin.

From the six participating provinces, whole or partial responses were obtained from 418 beekeeping operations [13(PEI), 60(NS), 16(NB), 223(QC), 52(MB), 54(BC)]. These beekeepers collectively operated a total of 87,890 colonies during the summer of 2009 representing 14.4% of all managed honey bee colonies in Canada.

Based on responses to the harmonized survey, the following results are summarized across participating provinces (Tables 2, 3, 6) or by individual province (Tables 4, 5):

Table 2. 2009 Summer Management.

	Total Colonies	# Responding Beekeepers	Mean	Std. Error
What was the average honey yield in lbs. per production colony for 2009?	29,007	360	80.57	3.12
How many productive colonies did you have during the summer of 2009?	87,890	388	226.52	35.71
How many of your colonies were used for pollination in 2009?	48,376	369	131.10	32.50

Table 3. 2009 Fall Management.

	# Responses	Proportion
What type of sugar-based feed did you use in the fall?		
Table Sugar	107	26.6%
Sucrose Syrup	220	54.7%
High Fructose Corn Syrup	31	7.7%
Honey	43	10.7%
Other	1	0.2%
What method of feeding did you use?		
Barrel Feeding	48	12.1%
Individual Feeders	336	84.8%
Top Feeders	4	1.0%
Gallon Pail	2	0.5%
Other	6	1.5%
Did you monitor for *Varroa* mites in the fall?		
Yes	289	78.1%
No	119	21.9%
If so, what method of monitoring did you use?		
Mite wash	67	23.5%
Sticky Board	207	72.6%
Apivar	1	0.5%
Other	10	3.5%

If known, what was:	n	Mean	Std. Error
the level of infestation per adult bee (%) *	49	5.38	1.63
or the number of mites naturally falling on sticky boards per 24 hr period? *	25	18.36	4.83

Did you treat for *Varroa* in the fall?	n	Proportion
Yes	377	93.6%
No	32	6.4%

If 'Yes', which product did you use:		
Apistan	40	9.4%
CheckMite+	14	3.3%
Apivar	86	20.2%
Formic Acid	135	31.7%
Oxalic Acid	124	29.1%
MiteAwayII	27	6.3%

Did you monitor for *Nosema* disease?		
Yes	31	21.3%
No	117	78.7%

If 'Yes', what method of monitoring did you use?		
Spore Count	22	75.9%
Gut Colour Diagnostic	4	13.8%
Other	3	10.3%

Did you treat for *Nosema* disease in the fall?		
Yes	193	47.9%
No	210	52.1%

If 'Yes', what method of application did you use?		
Fumagillin in Sugar Syrup	176	95.1%
Fumagillin in Drench Application	5	2.7%
Other	4	2.2%

* Responses to these questions do not include Quebec beekeepers as equivalent questions were not asked.

Table 4. 2009-10 Winter Management.

	Total number of Colonies Wintered *(# Responding Beekeepers)*					
	BC	MB	QC	NB	NS	PEI
What was the total number of viable colonies being prepared for winter in your operation on October 1, 2009?	17,106 *(53)*	34,557 *(52)*	26,099 *(207)*	6,094 *(16)*	18,411 *(60)*	3,920 *(13)*
From the above total:						
How many were full-sized colonies wintered outdoors?	15,373 *(53)*	17,148 *(33)*	4,010 *(121)*	2,203 *(14)*	3,741 *(52)*	3,879 *(12)*
How many were full-sized colonies wintered indoors?	0	12,266 *(29)*	22,057 *(103)*	3,300 *(2)*	13,830 *(10)*	24 *(2)*
How many were nucleus colonies wintered outdoors?	1,730 *(22)*	2,003 *(7)*	N/A	545 *(5)*	133 *(9)*	17 *(2)*
How many were nucleus colonies wintered indoors?	0	3,140 *(17)*	N/A	46 *(1)*	747 *(5)*	0

Table 5. 2009-10 Winter Mortality (Colony Loss).

	Total Number of Colonies Surviving *(Winter Mortality %)*						
	BC	MB	QC	NB	NS	PEI	Overall
On April 15, 2010, what was the total number of colonies still alive in your operation?	13,959 *(18.4)*	26,621 *(23.0)*	21,766 *(16.6)*	5086 *(16.5)*	11,122 *(39.6)*	3,266 *(16.7)*	81,820 *(22.9)*
From the above total:							
How many of the surviving colonies were full-sized & wintered outdoors?	13,017 *(15.3)*	12,241 *(28.6)*	3,323 *(17.1)*	1,837 *(16.6)*	3,137 *(16.2)*	3,241 *(16.5)*	36,796 *(20.6)*
How many of the surviving colonies were full-sized & wintered indoors?	0	10,083 *(17.8)*	18,414 *(16.5)*	2,750 *(16.7)*	7,224 *(47.8)*	18 *(25.0)*	38,489 *(25.2)*
How many of the surviving colonies were nucs & wintered outdoors?	942 *(45.6)*	1,662 *(17.0)*	N/A	499 *(8.4)*	118 *(11.3)*	7 *(58.8)*	3,228 *(27.1)*
How many of the surviving colonies were nucs & wintered indoors?	0	2,635 *(16.1)*	N/A	0	643 *(13.9)*	0	3,278 *(16.7)*
On May 1, 2010, how many full-sized colonies that survived the winter were considered commercially viable (i.e. with 4 or more frames of bees)?	11,678 *(24.0)*	21,400 *(25.6)*	15,900 *(21.3)*	4,380 *(20.4)*	10,211 *(41.9)*	N/A***	64,760 *(27.3)*

*** Insufficient data for reliable calculation of mortality at level of province.

Table 6. Causes of Winter Loss as Attributed by Beekeeper.

	# Responding Beekeepers	Mean
What percentage of losses over the period October 1, 2009 - April 15, 2010 would you consider acceptable:		
For your operation?	176	13.95
For your region?	132	15.68
	# Responses	**Proportion**
What do you think was the major cause of winter colony death in your operation?		
Weak colonies in the fall	143	20.7%
Poor queen quality	137	19.9%
Ineffective Varroa *control*	108	15.7%
Starvation	96	13.9%
Weather	84	12.2%
Nosema spp.	61	8.8%
Don't Know	22	3.2%
Raccoons	1	0.1%
Rats/mice	3	0.4%
Bears	3	0.4%
Other reasons	32	4.6%

Losses on Vancouver Island

Though overall losses in Canada improved in 2009-10, one notable exception was Vancouver Island, BC where exceptional mortality was recorded. Based on responses to provincial surveys, 69% of all colonies were lost by 15 April 2010 while the loss rate for commercially viable colonies by 1 May was 76%. Some producers sustained total loss.

Beekeepers on Vancouver Island observed that population declines occurred early, starting in the fall after colonies were prepared for winter with much of the mortality taking place by mid-December.

Based on reports from extension professionals in British Columbia, the majority of producers relied on Apistan (fluvalinate) for their *Varroa* mite control in the fall. Very few had ever used CheckMite+® (coumaphos) and none used Apivar® (Amitraz). Most also used formic acid treatments (as an alternative treatment in the spring) while others also applied oxalic acid. Generally, follow-up checks for mite levels after treatments were not performed and resistance to fluvalinate, widespread in mainland regions of the province, is suspected.

Nosema spp. are not thought to have played a significant role in Vancouver Island losses as most producers treated with the drug fumagillin. In addition, adult bee samples submitted to BC Ministry

of Agriculture and Lands laboratories had low or negligible levels of *Nosema* spores. For those honey bee viruses monitored in BC (IAPV, KBV), detections have occurred in previous years from Vancouver Island beekeeping operations.

Though no clear answers appear to exist for losses in this region, the efficacy of *Varroa* mite treatments, the susceptibility of locally-selected stock to mites and the lack of rotational replacement (or disinfection) of beekeeping equipment are all factors being examined as possible causes of high losses in this region.

Overwintering Losses in the U.S. (Spring 2010) [1]

The information for U.S. losses is derived from a survey commissioned by the Apiary Inspectors of America (AIA) and the USDA-ARS Beltsville Honey Bee Lab. In total, 4,207 American beekeepers responded to the on-line survey and an additional 24 were contacted by phone.

In the United States, a total loss of 33.8% of managed honey bee colonies was recorded. This compares to total losses of 29%, 35.8% and 31.8% recorded respectively in the winters of 2008/2009, 2007/2008 and 2006/2007.

The American survey was not designed to differentiate between true cases of Colony Collapse Disorder (CCD) and colonies lost due to causes that share the "absence of dead bees" symptom, typically associated with CCD. Only 28% of operations reported that at least some of their dead colonies were found dead without dead bees. However this group lost a total of 44% of their colonies, as compared with the total loss of 25% experienced by beekeepers who did not report losses indicative of CCD.

Of interest, responding U.S. beekeepers attributed their losses to starvation (32%), weather (29%), weak colonies in the fall (14%), mites (12%), and poor queens (10%). Only 5% of beekeepers attributed CCD as the major cause for their losses. This continues to underscore the need for research, not only into CCD, but into pollinator health in general.

[1] From: van Engelsdorp, D., Hayes, J., Caron, D. and J. Pettis. 2010. Preliminary results: honey bee colonies losses in the U.S., winter 2009-2010. http://ento.psu.edu/pollinators/news/losses-2009-10.

Is CCD in Canada?

The symptoms by which CCD is being characterized in the U.S. have not been routinely diagnosed by professional apiculturists in Canada. Though Canadian bees do not seem to be experiencing classic CCD-like symptoms, it is important to emphasize than higher levels of wintering and spring mortality in Canada may be related to the same casual factors as CCD losses in the U.S. Because longer winter conditions preclude the active brooding and flying of colonies found in early-season pollination areas of the U.S., colonies in Canada may not exhibit similar colony-level symptoms. Instead, it is conceivable that Canadian producers may simply see these effects as higher numbers of dead colonies following winter or those described as dwindling during early spring.

Most scientists in the U.S. and Canada would agree that what is being described as CCD in the U.S. and the high winter losses seen in Canada are likely being caused by several common interacting stress factors acting on honey bee colonies. Researchers in both countries are examining similar root causes of these stresses and their effects on bees.

What is being done in Canada?

Researchers in Canada remain in close contact with principal scientists participating in U.S. Working Groups on CCD. Members of CAPA have also been actively monitoring the status of bee health across the country and are sharing scientific information.

In 2009, the Canadian Pollination Initiative (CANPOLIN) was launched to address the growing problem of pollinator decline in agricultural and natural ecosystems in Canada. This initiative, funded as a five-year NSERC Strategic Network, includes researchers at 26 universities across the country that are working with government agencies, NGO's and industry to deliver critical insights and sustainable solutions to the pollination problem. The Scientific Director of CANPOLIN is CAPA member, Dr. Peter Kevan, of the University of Guelph. Other CAPA researchers comprise key working groups including those on managed pollinators. Refer to the CANPOLIN website for current information: http://www.uoguelph.ca/canpolin/

Work toward understanding the impact of *N. ceranae* in Canada also continues. Based on efforts in 2007 and 2008, it was initially determined that the parasite was present in all Canadian provinces, with *N. ceranae* and *N. apis* found in approximately similar proportions. This is in sharp contrast to the U.S. where *N. apis* is now seldom found in samples. Changes in the distribution and prevalence of these species will continue to be monitored.

The impact of *N. ceranae* on honey bees is not well understood and it is likely a factor in the survival of colonies already under multiple stresses. Currently, CAPA members employed by federal and provincial governments, as well those in Canadian universities, are undertaking research projects to better understand this parasite. Aims include determining the seasonal occurrence of *N. ceranae* in Canada, developing strategies for effectively managing this parasite as well as evaluating the use of novel therapeutic agents. Current indications suggest that *N. ceranae* is susceptible to fumagillin, the only registered therapeutic agent against *N. apis*. Nevertheless, much work is needed to determine best management practices to control this organism.

Researchers within CAPA are also evaluating alternative control options for *Varroa* mites, methods of integrated pest management (IPM) for honey bee colonies and the breeding of honey bee queen stock more tolerant of diseases and mites. Members of CAPA, in cooperation with the Canadian Honey Council, are also pursuing the registration of alternative products for *Varroa* control in Canada.

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